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Science and Art Gossip.

SIR W. THOMSON has been making experiments on sunlight, moonlight, and candlelight. The results are not in agreement with those hitherto obtained. He compares the amount of light from the sun, the moon, and skylight, with artificial light, by admitting the former through a small pinhole of measured diameter. The method seems open to exception, as light does not travel straight through a very small aperture, but undergoes diffraction. Be this as it may, some of the results are strangely inconsistent with those obtained by other methods. Thus Sir W. Thomson finds the intrinsic brightness of the Glasgow sun in winter three times as great as Arago found the average brightness of the sun in France to be. He finds the light of the full moon to be one-71,000th of the light of the mid-day sun, whereas Bouguer's early and imperfect experiments made the moon's light one-300,000th of the sun's. Wollaston set the proportion at less than one-800,000th, and Zöllner by two methods, each preferable to Sir W. Thomson's, obtained one-618,000th and one-619,000th, results which are not likely to be far wrong.

SIR W. THOMSON found the sun's light to be such as to correspond to an intrinsic lustre of the solar disc after absorption of the light by our own air, 53,000 times greater than that of a candle-flame. This, too, at mid-winter in Glasgow.

THERE is a charming paper by Prof. Wendell Holmes, in the *Atlantic Monthly*, which we are glad to see taking its place beside *Harper's* and the *Century* on our English booksellers' counters. The veteran writes much of his own experience as an author—the victim of those who regard the author as their common property, whether they be among those who admire him, or among those who (as some will in every case) detest heartily everything that he does, has done, or may do. One can hardly imagine any one disliking this most genial of humorists. Yet we have seen, and doubtless he has seen, too (for the participled good-natured friend we have always with us), criticisms by jaundiced folk, who have been wounded by some of his well-directed arrows of general sarcasm, not meant specially for them. They have not failed to tell him, only the world has not fully agreed with them, that he should promulgate opinions only on his own subjects (meaning those to which his professional office related), not on matters outside of it.

THE extensive offices of the Orient Steam Shipping Company were some time ago fitted, by the Electric Power Storage Company, with a gas-engine, a Siemens' dynamo machine, a number of Edison lamps, and a set of accumulators, and a contract was prepared, according to which the Orient Company was to pay a rent for the whole at the rate of £3 per lamp. The engine ran all day charging the batteries, but the lighting was unsatisfactory, and is now discontinued.

THE *Scientific American* (New York, December 30) quotes the following figures from the report of the Ohio State Inspector of Mines. The annual output of coal has increased from 5,315,294 tons in 1872, to 9,450,000 tons in 1882. The latter year showed more than 1,000,000 tons increase over 1881. Seventy million tons have, so far, been raised, and the inspector is of opinion that at least the same quantity has been wasted from the want of correct plans and engineering skill. The unworked coal of the State is estimated at 85,000,000 tons.

HOW HOGS PREVENT THE RENEWAL OF PINE FORESTS.—A correspondent writing from Johnsonville, S.C., incidentally mentions a curious instance of the influence of animals in controlling or preventing forest growths. It appears that the fondness of hogs for the juicy roots of young pines leads them to seek them assiduously, so that where hogs are allowed to roam in that region, one can hardly find a young long-leafed pine in a thousand acres of pine forest. There being no young trees to take the place of the old ones used up by the lumbermen and turpentine gatherers, that species of pine timber is rapidly being exterminated.

THE TELEPHONE.—The superintendent of the Nottingham fire station mentions that during the last year eight fires were reported by telephone through the Central Exchange and various police stations connected by the above company's system, and many thousands of pounds' worth of property was saved owing to the rapid means of communication afforded.

ACCORDING to statistics given by *L'Electricité*, the two nations that have adopted the telephone to the largest extent in proportion to their population are Belgium and Switzerland, the former counting a subscriber in every 399, and the other in every 227 inhabitants. There are 4,946 subscribers in England, 3,640 in France, and 2,142 in Germany. Paris alone has 2,422 subscribers, and there are more in New York than in the whole of England, while there are 37,187 in the United States.

A DISINFECTANT.—Mr. Mattieu Williams notes that sulphate of copper may be usefully employed as a disinfectant. It may be bought at sixpence or less per pound (they call it blue vitriol) in the shops, and is readily soluble in water. "I have lately used it," he says, "in the case of a trouble to which English householders are too commonly liable, and one that has in many cases done serious mischief. The stoppage of a soil-pipe caused the overflow of a closet, and a consequent saturation of floor-boards, that in time would probably have developed danger by

nourishing and developing the germs of bacteria, bacilli, &c., which abound in the air, and are ready to increase and multiply wherever their unsavoury food abounds. By simply mopping the floor with a solution of these green crystals, and allowing it to soak well into the pores of the wood, they (the pores) cease to become a habitat for such microscopic abominations. The copper salt poisons the poisoners. It occurs to me that this would be a useful and interesting subject of inquiry for young microscopists. Mr. Slack is now showing in the pages of Knowledge how the microscope may be directed to inquiries respecting the germs of life. Chemistry might usefully be combined with such microscopical inquiry, and after the experiments he suggests have been made, so far as the bacteria, bacilli, &c., are concerned, the solutions containing these objectionable beings may be dosed more or less liberally with solutions of blue vitriol, and of other reputed disinfectants, until their capacity for "poisoning the poisoners" has been thoroughly tested. The solution of sulphate should not be put into iron or zinc vessels, as it rapidly corrodes them, and deposits a non-adherent film of copper. "It will even," says Mr. Williams, "disintegrate common earthenware, by penetrating the glaze, and crystallising within the pores of the ware." Stone-ware resists them, and they may be safely kept in wooden buckets.

The directors of the Brush Midland Electric Light Company have agreed to ask the Court for liberty to strike out from the share register the names of those shareholders who desire the return of their capital, and to refund them the amount paid on their shares.

The American *Railroad Gazette* says:—"The two most gorgeous sections of railroad in the world will be on the Marretta and North Georgia and the Western North Carolina at Red Marble Gap, N.C. Both roads will run for a mile on road beds composed of variegated marble of the finest quality."

A total of about 800 millions—an amount exceeding the whole of the National Debt—is invested in railways in the United Kingdom. Of this sum about 190 millions represents debenture stocks of dividend-paying railways, affording an industrial security as good as National Consols. Nearly 300 millions of the capital consists of Guaranteed and Preference Stocks, and 330 millions—including 40 millions expended upon uncompleted lines, or others which pay no dividend—pays less than 3 per cent. The railways paying no dividend decrease every year, the improvement in the poor lines being much more marked than in those paying good dividends.

At the recent American Forestry Congress, held at Montreal, Professor Hough read a paper on "Tree Planting by Railway Companies." In introducing his paper he said that there being in the United States about 100,000 miles of railway, the advisability of tree planting by railway companies for construction and maintenance was an important question, 2,000 to 3,000, and even 3,500, ties (sleepers) being used per mile. The average duration of ties is from five to eight years, consequently from 30,000,000 to 50,000,000 a year will be required for 100,000 miles of railway. Putting 500 ties as the product of an acre of woodland, from 60,000 to 100,000 acres will have to be cut every year, and as it takes thirty years for a tree to grow to the right size, the railway, will require from 2,000,000 to 3,000,000 acres—or 3,126 to 4,687 square miles of forest to keep up the supply. At this rate, the *Railway Review* says, there should be twenty-five acres for each mile of road, involving an investment of £100 in land per mile—a wise investment, giving the railways an independent supply of ties. He stated that wood fuel is being superseded by coal, and wooden bridges by stone or iron. In Europe, wood in railway structures is very rare, and for ties, mineral substances will be much dearer than wood for some time. The professor concluded his paper with some references to the necessity of planting trees to hold embankments together by their roots, and alder and willow to prevent erosion of streams, and the various kinds proper to plant for different purposes and in different localities; also the prevention of snow-blocks by having trees along the railway tracks.

An earthslip which occurred near Fort de l'Ecluse nearly caused (says the *Engineer*) one of the most calamitous inundations on record. On Tuesday night, the 2nd inst., an old railway watchman, who lives in a cabin between the station of Collonges and the long Credo tunnel which runs under the pass to Bellegarde, felt his house shake and heard a noise like thunder. Feeling sure that something was wrong, and knowing that the train which leaves Geneva at midnight was due, he ran along the line, placing detonators on the rails as he went. By this device he succeeded in stopping the train, and not a minute too soon, for the noise he had heard came from an earthslip, which carried 200 mètres of the permanent way bodily into the Rhône, whither, the Geneva correspondent of the *Times* says, but for the old man's presence of mind, the train must inevitably have followed it. The line from Geneva before entering the great Credo tunnel passes through a short one immediately below the fort. On Wednesday a great mass of earth fell from the mountain directly above the smaller tunnel, and completely blocked the course of the Rhône. At noon the tunnel itself fell with a report that was heard for miles. The water accumulated behind the barrier with frightful rapidity, and if it had gone on gathering, even for a day or two, the consequences would have been frightful—the valley of the Rhône as far as Lyons would have been swept as by an avalanche. As it was, the dam burst a few hours after the second earthslip.

A terrible storm, the like of which has never yet been seen, is predicted for March 11 next. Dr. E. Stone Wiggins, of Ottowa, Canada, the prophet in the case, writes to the President of the United States:—"No vessel, whatever her dimensions, will be safe out of harbour, and none of small tonnage can hope to survive the tidal wave and fury of this tempest." The prediction has been so seriously received by the City Surveyor of New York, that he has written to Dr. Wiggins asking whether that alarmist gentleman would recommend the stoppage of some extensive marine works on which he is engaged until after the dreadful hurricane has passed. Other people besides the City Surveyor of New York have been stricken with panic. Such, indeed, are the apprehensions prevailing, that General W. H. Hazen, the chief of the Weather Bureau at Washington, has taken the trouble to expose the fallacies on which Dr. Wiggins bases his prediction. On the other hand, an American journal gets some fun out of the affair. "President Arthur," it remarks, "having received timely warning, has instructed the Secretary of the Navy to employ a few horses and have our war vessels hauled up into a field, and have a shed built over them. This precaution may entail an expense of eight or nine hundred dollars, but the American Navy must and shall be preserved."

A NATURALIST'S YEAR.

By GRANT ALLEN.

V.—GORSE BLOSSOMS.

OUT on the common here the flowers of the season are now few and far between indeed. To be sure, there are some small blossoms that almost never desert us, even when the frost is on the ground. Yonder small white shepherd's purse under shelter of the furze-bushes is one such example; and here are a pair of others, little blue ground-veronica, and purple lamium, with its arched red hoods. Most of these hardier native winter-flowering plants, however, are mere insignificant creeping weeds, scarcely noticed at all by the average observer. But there is at least one English winter blossom whose prettiness and sweetness nobody can deny, and that is the larger gorse, which grows so plentifully on all our heaths and commons. Everybody knows that gorse flowers all the year round, though it is not everybody who knows the real reason why it does so. The fact is, we have two distinct species of furze in England; the greater gorse, which flowers from autumn to spring; and the dwarf gorse, which flowers alternately with it, from spring to autumn. The two plants differ, not only in stature and time of blossoming, but also in hairiness and in the size of the tiny bracts that enclose the calyx. As soon as one has begun to set its small woolly pods, the other begins to flower in its stead; and so between them they keep up an endless succession of blossoms for the bees, and effectually ensure the well-known principle that kissing is never out of fashion.

Gorse belongs by family to the pea-flower tribe, but it is one of the least pea-like and most bushy of our English papilionaceous plants. When it grows first from the seed-bean, it sends up young shoots with trefoil leaves, after the fashion of so many other pea-flowers, such as clover and nonsuch; but as it grows older, its leaves become longer and narrower, until at last they assume the familiar form of long stiff green prickles. This peculiar type of leaf, as well as the bushy character, is due to the nature of the places in which the furzes grow. They are by habit denizens of wild and open spots, much overrun (in the original state at least) by herbivorous animals. Under such circumstances, only those plants would survive which were least attractive to, or best defended against, the aggressive ruminants. Now, we all know that the pea tribe as a whole are great favourites with animals, both on account of their tender foliage, and of their richly-stored seeds; so much so that many of them are specially grown for fodder, as in the case of purple clover, Dutch clover, crimson trifolium, lucerne, nonsuch, vetches, horse-beans, and many others. Hence the only peaflower plants which succeed well in open situations (except, of course, when artificially protected by man) are those with very stringy stems and hairy pods, like lady's-fingers, or those which have assumed the bushy character, like broom or gorse. Even broom, however, has been less successful in this respect than gorse, for the one has comparatively large and broad trefoil leaves, perfectly edible, though not very nutritious; while the other has stout prickles in their place, which no animal can venture to attack. The thistle-loving donkey himself shrinks from the well-armed branches of the furze; and so the veriest suburban common or village green is commonly covered in great patches with its dark green foliage and its pretty golden bloom. No other British plant whatsoever has managed to acquire an equally deterrent and protective habit. To the last, however, furze bushes retain some memory of their original broom-like foliage; for if you look closely on the lower branches, or near the base of the stem, you will often find a few leaves of a long narrow type, not unlike the topmost leaves of the true broom.

The flowers of the gorse form its great attraction in the eyes of the world at large; and, indeed, they are so beautiful when fully out that one can hardly wonder at Linnæus, who, when he first beheld the bush in all the golden glory of its blossoming season, fell down on his knees and thanked God fervently for the creation of so exquisite a plant. Just at present, the flowers are only struggling out by twos and threes in little patches, and the branches are covered for the most part with small brown hairy knobs, the unopened buds, which are only waiting for a spell of more genial weather to burst their dusky sheaths and herald spring before its time. This hairiness of the calyx is one of the best signs by which you can tell the greater gorse from its dwarf congener; while at the same time the two little bracts which protect the base are here much larger than in the summer-flowering species. Both these peculiarities show that the winter-blooming gorse finds some special necessity for protecting its young flower-buds, which is not equally felt by its summer neighbour; though what exactly the danger it has to guard against may be I cannot say. Even to-day, in spite of lowering cloud and chilly weather, a solitary bumble-bee has found his way to the sweet-scented blossoms, and is taking his fill from the luscious honey at the base of the petals. The way the gorse manages its fertilisation is extremely curious, and I can see it at work here under my very eyes as the bee bustles about in his burly fashion from flower to flower. He lights on the keel or lowermost petal, which has two little pits or depressions, one on each side, fitted exactly to receive his feet; and his weight then presses down the keel, so that the stamens within fly up elastically, and dust his breast all over with their golden pollen. As the stigma (or sensitive surface of the ovary) is enclosed in the stamen-tube, it also comes into contact with his breast at the same time, and rubs off it some of the pollen brought from the last flower which he happened to visit in the course of his rounds. You can push down the keel of a gorse blossom for yourself with your finger, and you will see the pollen fly out in a little cloud, like spray from a child's squirt; only you must take care to experiment upon a fresh flower, not yet visited by the bees, or else you will find the keel already depressed, and the pollen shed before your arrival. The bees themselves know at once which flowers are fresh, and which have been previously rifled, by observing the position of the keel; and they never waste their precious time by searching for non-existent honey in an exploded blossom. This mode of fertilisation, though found in gorse, broom, genista, and several similar peaflowers, is by no means the only method adopted by the tribe; there are many other devices in other plants of the same family, some of which I may, perhaps, have occasion to explain when the bird's-foot trefoil and the purple clover come into blossom in the long summer days. Even within the limits of a single closely-related group, the variety and ingenuity of nature is practically infinite.

After the bee has impregnated the flower, the pollen left on the stigma begins to penetrate the young pod, and quickens into life the tiny embryo beans that lie within it. Then the pod swells slowly, and assumes its characteristic stumpy shape. The beans are few in number, and much compressed against one another; and the pod is extremely short, scarcely exceeding the calyx in length. There is a good reason for all this, and also for the stiff woolly hairs that clothe the outer surface. All the peaflowers produce rich seeds, abounding in starch; and many of them are

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accordingly used for food as pulse, like our own peas, haricot beans, scarlet runners, vetches, lentils, and so forth. Hence it is particularly necessary for them to guard against the depredations of animals, and this many of them have done by acquiring prickly pods or by curling themselves round into inconspicuous little balls. Gorse, however, is so far protected already by its stout sharp leaves that it does not require any special device of such a sort: it is sufficient that the little pods should not protrude beyond the average length of the surrounding bristles. If they were very long and pendulous, animals and birds might pick them off without getting pricked; as it is, the whole bush is so self-contained, and forms such a compact bristling mass, that nobody ever attempts to molest it in any way. If they do succeed even in getting off one pod, the harsh hairs on the surface are quite enough to prevent them from ever repeating the experiment. Indeed, all of us who have once tried to pick a beautiful blossoming spray of gorse in early spring, with all our civilised appliances of gloves, handkerchief, and pocket-knife, know by hard experience that its proud motto is "Nemo me impune lacessit." To the lower animals, it proves indeed an unapproachable enemy, always on the defensive alone, but always ready to repel the slightest attack upon its individual rights and liberties. For good or for evil, it seems the very model of a truly British plant.

STAYS AND STRENGTH.

By Richard A. Proctor.

MUCH space has already been given to this subject (but it is one of great importance), therefore I must be brief in what remains to be said. To say truth, if I can judge from the letters which reach me, very few hold the views which have been so stoutly maintained by "An Observer," and it seems the less necessary to advocate at any length the contrary and (I cannot but think the common sense) doctrine.

I set on one side all I had intended to say on the artistic aspect of the matter—adding only a few words in response to "An Observer's" remarks on this point in our last. He appears to think that only some American artist regards a tightly-laced waist as a deformity. I have talked with many artists both here and in America on this question, and I have never yet met with *one* who held a different opinion. Not a few admit that in portrait painting the deformity must be left,—just as a natural deformity (Cromwell's wart, for instance) would be left. In paintings like Frith's, again, the deformed waists must be shown—to remove them would be falsifying the history of our time. We see them in Hogarth's paintings (he even caricatures the absurdity, and in his illustrations of the "line of beauty," ridicules it sharply); they are seen in pictures belonging to almost every age of civilization, from Egyptian times to the present day. This proves, if "An Observer" will, that slender waists are admired; so they are, and very justly; so are small feet and small hands admired; and many whose hands or feet are not small, though their brains are, wear gloves and shoes too small for them, spoiling the shape in trying to reduce the size. That is just what the tight-lacers do with the waist. A girl will say she wears "fives" in gloves, "twos," or less, in shoes, as if that of itself meant pretty hands and feet. In the same way, a girl who wishes to match her brains with her waist, will talk of nineteen inches waist measurement (speaking even of that as "immense," to try to make folk believe that if she pleased she could pinch it to sixteen or seventeen inches*), as if small circuit meant beauty, and shapeliness counted for nothing. The beauty of a really shapely waist is seen far more in its narrowing from front to back, than in its compression from side to side; but it is seen even more in the undulating outline of its horizontal section; and more still in grace of movement. On these points all sculptors and painters are agreed, and as I should imagine all who have any eye at all for beauty. They are not likely to change their views because there "come you in" certain women with pigeon-toed feet, glove-bursting hands, and waist compressed to hideous roundness and rigidity.

On the health question I leave doctors to speak. I know that ninety-nine out of a hundred oppose tight-lacing with whatever form of stays, and of the hundredth, whether in private practice or as army surgeon (with "unusually wide shoulders and 23 inch waist"), I shall only say that no profession can be absolutely free from the unwise, and that I trust no one in whom I take interest may ever come under that hundredth person's medical ministrations.

Longevity proves only that Nature can adapt herself amazingly. Creaking gates hang proverbially long on their hinges.

But I happen to have facts for "An Observer"—not a multitude of facts, for the great multitude of men have simply nothing to say, having never tried lacing at all, while those who have tried it and have got no good from it are apt to hold their peace for very obvious reasons (which is perhaps the reason why all the arguments are one way, and all the evidence—*i.e.*, stated evidence—of facts, the other).

I offer first my own evidence, not very willingly, for I am not particularly proud to have it to offer. When this matter was under discussion in the pages of the *English Mechanic*, I, like "An Observer," was struck with the apparent weight of evidence in favour of tight-lacing. I was in particular struck by the evidence of some as to its use in reducing corpulence. I was corpulent. (I am not lean now, but I was some 20 lb. heavier then). I also was disposed, as I am still, to take interest in scientific experiment. I thought I would give this matter a fair trial. I read all the instructions (by the way, what a nuisance that word "read" is, one can never tell whether it is past or present,—I mean it here to sound as "red"); carefully followed them; varied the time of applying pressure with that "perfectly stiff busk," about which the correspondents of the *English Mechanic* were so enthusiastic. I was foolish enough to try the thing for a matter of four weeks. Then I laughed at myself as a hopeless idiot, and determined to give up the attempt to reduce by artificial means that superabundance of fat on which only starvation and much exercise, or the air of America, has ever had any real reducing influence. But I was reckoning without my host. As the Chinese lady suffers, I am told, when her feet-bindings are taken off, and as the flat-head baby howls (so Dr. Leigh informs me) when his head-boards are removed, so for a while was it with me. I found myself manifestly better in stays. And now, perhaps, "An Observer" will see what I meant when I said that if a man finds himself better in stays it shows that stays are weakening. I laughed at myself no longer. I was too angry with myself to laugh. I would as soon have condemned myself to using crutches all the time, as to wearing always that beast of a

* "An Observer" seems not to have caught Dr. Lewis's sarcasm on this point. The tight-lacers, hand-pinchers, and foot-squeezers always speak of their manufactured waists, hands, and feet as "immense"—first to suggest natural smallness, but chiefly as fishing for compliments.

busk. But for my one month of folly I had to endure three months of discomfort. At the end of about that time I was my own man again.

I hoped that reasoning, without evidence from my own experience, would have sufficed; but rather than any reader of KNOWLEDGE should be deluded into experiments which I know he would repent, I have told the story of my own stupidity. "I will rail" in this matter "against no breather than myself, against whom I know most faults."

But I have another little tale, somewhat pleasanter, to tell, and as likely to be instructive. It is told, "with permission":—

An American lady in my own family circle has throughout girlhood and to the present time worn corsets, but not tightly-laced ones. Her waist measurement as a girl—perhaps to the age of eighteen or so—was 19 inches, which she did not (nor does any American lady) consider 'immense.' But it should be noted that not only are American girls (of families long resident there) of slighter build on the average than English ones, but there is a tendency in America, not exactly to leanness, but certainly to an absence of any redundancy of adipose tissue. (I have never visited America without losing full 30 lb. in weight in the first four or five months; and in 1875-76 my weight was diminished from 14 st. 3 lb. to 11 st. 10 lb. without any use of anti-corpulence diet or regimen.) This lady, who has resided now some eighteen months in England, has added some 20 lb. to her weight; but would still be regarded as slight and small-waisted,—except, perhaps, by that army-surgeon, with 23-inch stays and unusually wide shoulders (how pretty he must look!); for with wide, but not unusually wide, shoulders, her waist-measurement is about the same as the stays-measurement (a very different thing) of that medico-military-monstrosity. To make the evidence complete, it should perhaps be added that the lady married eight years since, is still several years on the better side of thirty, and that her fourth child is now a bouncing boy of eleven months.

It so befell that at Christmas time this lady was very busily engaged in certain house decorations. She found the bones of her corset (steels, I suppose they should be called) very much in the way, even after—in stooping, bending, reaching for nails, and so forth—she had succeeded in breaking every one of them. It occurred to her that after all it was very doubtful whether the corset could be of much use, any way, since it had always been perfectly loose. She therefore discarded it. (No, gentle reader, not at my suggestion in any way whatever; except that as a reader of KNOWLEDGE this lady had, no doubt, followed the discussion in these pages.) The result certainly did not suggest that the wearing of loose stays has any beneficial effect, whatever good may (according to "An Observer") result from a compression of 7 or 8 in. For the result was simply a marked increase of comfort (due care having been taken to supply the necessary protection against cold). No one would have known that any change whatever had been made, except for a somewhat greater pliancy of figure. Had she been a tight-lacer before, this last change might have been more marked; but in that case I know the corset must soon have been worn again, unless she had been willing to endure great discomfort for a while. I must, in fairness, admit that she recognised one disadvantage—I might, perhaps, say two. Dresses carefully fitted to her corset no longer fitted or hung quite so well (though I doubt if any male eye could have detected the change). This, however, is precisely what the Rational Dress Society has pointed out as sure to follow if heavy skirts are worn without some supporting cincture.

THE BIRTH AND GROWTH OF MYTH.

BY EDWARD CLODD.

IN selecting illustrations from the literature of savage mythology, the material overburdens us by its richness. Much of it is old, and, like refuse-heaps in our mining districts, once cast aside as rubbish, but now made to yield products of value, it has, after long neglect, been found to contain elements of worth, which patience and insight have extracted from its travellers' tales and quaint speculations. That for which it was most prized in the days of our fathers is now of small account; that within it which they passed by we secure as of lasting worth. Much of that literature is, however, new, for the impetus which has in our time been given to the rescue and preservation of archaic forms has reached this, and a host of accomplished collectors have secured rich specimens of relics, which in the lands of their discovery have still the authority of the past, unimpaired by the critical exposure of the present.

The subject itself is, moreover, so wide-reaching, bringing the ancient and the modern into hitherto unsuspected relation, showing how in customs and beliefs, to us unmeaning and irrational, there lurk the degraded representations of old philosophies, and in what seems to us burlesque, the survivals of man's most serious thought.

One feels this difficulty of choice and this temptation to digress in treating of that confusion inherent in the savage mind between things living and not living, which was the main subject of my former paper. By numberless illustrations at hand, this confusion might be shown to extend to the names or images of persons, and to the persons themselves, as well as to other relations which are purely symbolical.

For example, the practice of burning or hanging in effigy, by which a crowd expresses its feelings towards any unpopular person, is a relic of the old belief in a real and sympathetic connection between a man and his image; a belief extant among the unlettered in by-places of civilised countries. When we hear of North American tribes making images of their foes, whose lives they expect to shorten by piercing these images with their arrows, we remember that these barbarous folk have their representatives among us in the Devonshire peasant, who hangs in his chimney a pig's heart stuck all over with thorn-prickles, so that the heart of his enemy may likewise be pierced. The practice among the Dyaks of Borneo, of making a wax figure of the foe, so that his body may waste away as the wax is melted, will remind the admirers of Dante Rossetti how he finds in a kindred mediæval superstition the subject of his poem "Sister Helen," while they who prefer the authority of sober prose may turn to that storehouse of the curious, Brand's "Popular Antiquities." Brand quotes from King James, who, in his "Dæmonology," book ii. chap. 5, tells us that "the devil teacheth how to make pictures of wax or clay, that by roasting thereof the persons that they bear the name of may be continually melted or dried away by continual sickness;" and also cites Andrews, the author of a "Continuation of Henry's Great Britain," who, speaking of the death of Ferdinand, Earl of Derby, by poison, in the reign of Elizabeth, says: "The credulity of the age attributed his death to witchcraft. The disease was odd, and operated as a perpetual emetic; and a waxen image, with hair like that of the unfortunate earl, found in his chamber, reduced every suspicion to certainty." The passage from practices born of such beliefs to the use of

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charms as protectives against the evil-disposed and those in league with the devil, and as cures for divers diseases, is obvious. But upon this it is not needful to dwell; what has been said will suffice to show that the superstitious man is on the same plane as the savage, but, save in rare instances, without such excuse for remaining, as Bishop Hall puts it, with "old wives and starres as his counsellors, charms as his physicians, and a little hallowed wax as his antidote for all evils."

But we have travelled in brief space a long way from our picture of primitive man, weaving out of streams and breezes and the sunshine his crude philosophy of personal life and will controlling all, to the peasant of to-day, his intellectual lineal descendant, with his belief in signs and wonders, his forecast of fate and future by omens, by dreams, and by such pregnant occurrences as the spilling of salt, the howling of dogs, and changes of the moon—in short, by the great mass of superstitions which yet more or less influence the intelligent, terrorize the ignorant, and delight the student of human development.

As, however, a good deal hinges upon the evidences in savage myth-making of the personification of the powers of nature, we must return to this for awhile. Obviously, the richest and most suggestive material would be supplied by the striking phenomena of the heavens, chiefly in sunrise and sunset, in moon, star, star-group, and meteor, cloud and storm, and, next in importance, by the strange and terrible among phenomena on earth, whether in the restless waters, the unquiet trees, the grotesquely-shaped rocks, and the fear inspired in man by creatures more powerful than himself. Though the whole range of the lower culture, sun, moon, and constellations are spoken of as living creatures, often as ancestors, heroes, and benefactors who have departed to the country above, to heaven, the *heaved*, up-lifted land. The Tongans of the South Pacific say that two ancestors quarrelled respecting the parentage of the first-born of the woman Papa, each claiming the child as his own. No King Solomon appears to have been concerned in the dispute, although at last the infant was cut in two. Vatea, the husband of Papa, took the upper part as his share, and forthwith squeezed it into a ball and tossed it into the heavens, where it became the sun. Tonga-iti sullenly allowed the lower half to remain a day or two on the ground. But seeing the brightness of Vatea's half, he compressed his share into a ball and tossed it into the dark sky, during the absence of the sun in the nether world. Thus originated the moon, whose paleness is owing to the blood having all drained out of Tonga-iti's half as it lay upon the ground. Mr. Gill, from whose valuable collection of southern myth this is quoted, says that it seems to have its origin in the allegory of an alternating embrace of the fair Earth by Day and Night. But despite the explanations, more or less strained, which some schools of comparative mythologists find for every myth, the savage is not a conscious weaver of allegories, or an embryo Cabalist, and we shall find ourselves more in accord with the laws of his intellectual growth if, instead of delving for recondite and subtle meanings in his simple-sounding explanations of things, we take the meaning to be that which lies on the surface. More on this, however, anon. Among the Red Races, one tribe thought that sun, moon, and stars were men and women who went into the sea every night and swam out by the east. The Bushmen say that the sun was once a man who shed light from his body, but only for a short distance, until some children threw him into the sky while he slept, and thus he shines upon the wide earth. The Australians say that all was darkness around them till one of their many ancestors, who still shine from the stars, shedding good and evil, threw, in pity for them, an emu's egg into space, when it became the sun. Among the Manacicas of Brazil, the sun was their culture-hero, virgin-born, and their jugglers, who claimed power to fly through the air, said that his luminous figure, as that of a man, could be seen by them, although too dazzling for common mortals.

The sun has been stayed in his course in other places than Gibeon, although by mechanical means of which Joshua appears to have been independent. Among the many exploits of Maui, abounding in Polynesian myth, are those of his capture of the sun. He had, like Prometheus, snatched fire from heaven for mortals, and his next task was to cure Ra, the sun-god, of his trick of setting before the day's work was done. So Maui plaited thick ropes of cocoa-nut fibre, and taking them to the opening through which Ra climbed up from the nether world, he laid a slip-noose for him, placing the other ropes at intervals along his path. Lying in wait as Ra neared, he pulled the first rope, but the noose only caught Ra's feet. Nor could Maui stop him until he reached the sixth rope, when he was caught round the neck and pulled so tightly by Maui that he had to come to terms, and agree to slacken his pace for the future. Maui, however, took the precaution to keep the ropes on him, and they may still be seen hanging from the sun at dawn and eve. In Tahitian myth, Maui is a priest, who, in building a house which must be finished by daylight, seizes the sun by its rays and binds it to a tree till the house is built. In North American myth, a boy had snared the sun, and there was no light on the earth. So the beasts held council who should undertake the perilous task of cutting the cord, when the dormouse, then the biggest among them, volunteered. And it succeeded, but so scorched was it by the heat that it was shrivelled to the smallest of creatures. Such a group of myths is not easy of explanation; but when we find the sun regarded as an ancestor, and as one bound, mill-horse-like, to a certain course, the notion of his control and check would arise, and the sun-catchers take their place in tradition among those who have deserved well of their race. It is one among numberless aspects under which the doings of the sun and of other objects in nature are depicted as the doings of mortals, and the crude conceptions of the Ojibwas and the Samoans find their parallel in the mythologies of our Aryan ancestors. Only in the former we see the mighty one shorn of his dignity, with noose round his neck or chains on either side; whilst in the latter we see him as Herakles, with majesty unimpaired, carrying out the twelve tasks imposed by Eurystheus, and thus winning for himself a place among the immortals.

THE WEATHER PROPHECIES.

THE following very amusing and effective letter appeared in the *Times* of Wednesday, Jan. 17:—

"One hears such opposite opinions confidently expressed about the value of the official weather prophecies that I wonder nobody has taken the trouble to test them by actual history for a few weeks, and publish the result. It lately occurred to me to do so, and here is the result for a lunar month, which is amply sufficient for the purpose. I need hardly say that if they are not oftener right than wrong for each district they are useless; and if they are oftener wrong than right they are worse than useless, and we had better toss up daily for the weather on each point, of hot or cold, wet or dry, foggy or clear, windy or still. In the following list the quotation marks give the prophecies, and

H. the history of the weather from sunrise to 9 or 10 p.m. within the horizon of chimney-pots visible to me during that time. When H. omits the wind, it agreed with the prediction. I cannot tell what H. may have been for other parts of 'England, S. (London and Channel);' but a writer from Southsea in the *Times* of to-day does not seem to have found much more of fulfilled prophecy there of late than we have here:—

"Dec. 18. 'Wind strong to a gale, cold rain and snow.' H.—The finest and warmest day for a fortnight; quite still; a little fog.

"Dec. 19. 'South-east breezes, light to calm, colder, clear in some places, foggy in others;' which means in each place 'either clear or foggy'—a very safe prophecy. H.—No colder; fine, but rather foggy, no breezes.

"Dec. 20. 'Variable airs or calms' (safe again); 'foggy generally and cooler.' H.—Rather warmer; some fog.

"Dec. 21. 'South-west winds, freshening; cloudy, some rain.' H.—Very fine nearly all day; a few drops of rain; no wind.

"Dec. 22. 'West to south-west, moderate to fresh or strong; fine and cold at first, afterwards cloudy and unsettled, with some rain.' H.—No wind, no clouds, no rain, no change all day.

"Dec. 23. 'West to north-west, light to moderate or fresh, cloudy, unsettled; some cold showers.' H.—No showers, a little wind; fine; a few clouds.

"Dec. 25. 'South-west to west, light and moderate; cloudy generally, with some slight rain; milder.' H.—Milder and warm; rain from 10.30 to 3; no wind.

"Dec. 26. 'South-west and north-west, strong, very changeable and unsettled, with rain.' H.—Still, dull, very warm, rain early and late.

"Dec. 27. 'South-west and west, fresh, rain at times.' H.—Very warm and rainy.

"Dec. 28. 'South-west, strong, squally, perhaps a gale, rainy, mild.' H.—No rain, a little wind, warm and fine day.

"Dec. 29. 'Strong south-west gales, subsequently lulling, very squally, much rain.' H.—No rain enough to wet flags, no squalls, a little wind.

"Dec. 30. 'West to north-west or north, decidedly colder, and perhaps some cold showers.' H.—No north wind, no colder, rain nearly all day.

"Jan. 1. 'South-west and west, freshening, dull, close and wet.' H.—Damp, warm, slight rain occasionally, no freshening.

"Jan. 2. 'South-west and west, strong, cloudy, unsettled, rain at times.' H.—Fine till evening and colder, then rain; windy night.

"Jan. 3. 'West to north-west gales, moderating later, fair on the whole, but some showers; colder.' H.—North-west; still, cloudy, dark, no rain, no colder sensibly.

"Jan. 4. 'Variable airs, finally east or south-east, cold and foggy.' H.—South-east early, south-west late; not foggy, but dull, rather colder.

"Jan. 5. 'South-east and south, light or moderate, cloudy generally, some rain.' H.—South-west; fair morning, rain afternoon.

"Jan. 6. 'Light variable breezes, cloudy generally, with some fog; colder.' H.—Fine and sunny till afternoon; colder.

"Jan. 8. 'Freshening; east winds and dry weather; clear at times.' H.—Fine till evening, and then rain and warmer; little wind.

"Jan. 9. 'East and north-east, strong to a gale; cold showers at times.' H.—No showers till late; windy.

"Jan. 10. 'South and south-west, milder, changeable, clear to showery.' H.—Wind east, cold and dull, a few drops of rain.

"Jan. 11. 'Wind veering to south and south-west, milder, rain at times, with bright intervals.' H.—Wind east, dull all day, cold, no rain.

"Jan. 12. 'Wind veering to south or south-east, with still milder weather and clearer sky.' H.—Wind east, dull, not quite so cold.

"Jan. 13. 'South-east breezes, moderate or light; dull, foggy in many places.' H.—Wind east, a little rain, dull but no fog; rather warmer.

"I wrote this yesterday, intending to close the catalogue with the month, but I cannot help noticing the announcement of the secretary of the prophetic office this morning, that 'no definite forecasts are possible' to-day. I had written before that I was only sorry for the Government Zadkiel being expected to perform impossibilities, beyond proving that science knows less about the weather than many an old gardener or seaman. But I must not say that to philosophers who declare by this announcement that 'definite forecasting' is generally possible. Well, then, if it is, what have they to say to this catalogue of their successes? I see 'Old Moore' has given up the weather and sticks to politics and general mundane affairs as the more certain things to prophesy. I have not seen this year's real Zadkiel. I hope he is not dead, like the partridge who was killed by Swift.—Yours obediently,

"33, Queen Anne-street, *Jan.* 15. "EDM. BECKETT."

GREAT SUN SPOTS.

WHATEVER success science may have, or fail to have, in predicting terrestrial weather, there can be no doubt astronomers have learnt to predict with considerable correctness the occurrence of the mighty solar storms which produce what are called sun spots. They cannot yet say that on such and such a day, or even in such and such a week or month, a great spot will appear; but they can tell what years will be characterised by many sun storms, and what years by few, for ten or twelve years in advance. The great sun spots which have been seen during the last few months were predicted at least twelve years ago; and astronomy is far better assured that in the years 1893 and 1894 there will be many large sun spots than meteorologists are that next March will probably be stormy and next June relatively calm. Yet scarce half a century has passed since the periodicity of sun spots began to be recognised, and not a quarter of a century has passed since the theory was thoroughly established. We do not even yet know why these waves of sun spots pass in their long ten-yearly surge over the vast surface of the sun. The Kepler of the sun has done his work; the Newton has yet to come. The work of a solar Newton will be well worth doing, even though he may not (as he probably will) bear somewhat the same relation to Schwabe that the profound Newton bears to the ingenious and laborious Kepler.

What a problem it is that lies before astronomers when we consider what sun spots really mean! The great atmosphere of the sun, whose breath is flame, is yet so cool compared with his intensely glowing surface that it absorbs a large proportion of his light as well as of his heat. It absorbs so much that it actually changes his colour. There can be no manner of doubt, from what Professor Langley has shown about the absorptive qualities

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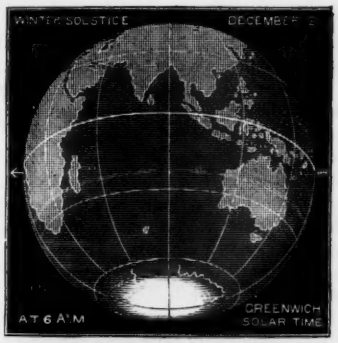
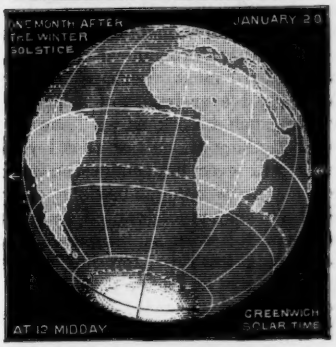
of that atmosphere, that were it suddenly stripped off, the sun would shine not only with greatly increased brightness, but with a bluish violet colour. In a very short time indeed that colour would seem white again to our eyes, grown accustomed to the change; after which, the sudden restoration of the absorbing atmosphere would change the sun to an orange-red orb, which only after awhile would seem to our eyes a white globe as before. But while the general absorptive action of the sun is wonderful, the story is still more wonderful which the spectroscope has to tell about the specific absorptive effects due to its constitution. We find that, whereas in our air the vapour of water is present (to condense into water drops and form clouds at certain levels, and to change to ice-crystals and form cirrus at higher levels), in the sun the atmosphere is laden with the vapours of iron, copper, zinc, sodium, magnesium, and like elements, to form clouds of metallic drops, great gatherings of metallic crystals, while the rains that pour down towards the concealed true globe of the sun are mighty showers of molten metal. When a hurricane occurs in the sun, the clouds which form the sun's surface are swept along, or whirled around, not at the rate at which we measure our storms, but with a velocity compared with which their swiftest motion is as rest. The solar tornadoes rage, not over a few hundred square miles, but over regions as large as the whole surface of the earth, over hundreds, even thousands of millions of square miles; and they travel over these enormous regions at a rate not of so many miles per hour or per minute, but of many miles, sometimes more than a hundred miles, in every second of time. Such storms are in progress now, where we see the spots upon the sun. Such storms tell us of the activity of that great central engine whose throbs are the life-beats of the solar system.

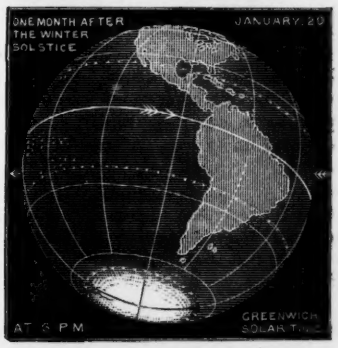
We measure the sun's work, perforce, by our own forms of work. We speak of his emission of light and heat as corresponding to what would result from the burning of eleven thousand millions of millions of tons of the finest coal in every second of time. But what mind can conceive the real vitality of that mighty orb which seems so silent and so still in our skies? The throbbing of the great engine which beats out light and life to the whole family of planets can only be seen by the mind's eye, and as yet that eye is no more capable of seeing the sun's work as it really is than is the bodily eye of seeing the distant millions of suns which the great gauging telescopes of the Herschels bring within our ken. Nor can the mental ear hearken to the uproar and tumult with which the work of the great central engine is accomplished, or imagine what would be heard if one could visit that spot which looks like a tiny speck on the sun's surface, and, passing below the limits of the solar air so that sound waves could reach him, could find (as assuredly he would, if he could live at a temperature which turns the hardest metal into vapour) all forms of noise known to us—the roar of the typhoon, the crash of thunder, even the hideous groaning of the earth-throe—surpassed a million-fold by what takes place within every square mile of that disturbed region.

One cannot wonder if many students of science are eager to find out the real meaning of the sun spots, to learn how they are generated, and to solve tho secret of that strange law which brings them in undulations ten or twelve years long over the surface of the sun. Still less can one wonder if many should be attracted by theories associating terrestrial phenomena, not in general (as they must assuredly be associated) but in detail, with the periodicity of solar disturbance. It has been shown that the earth as a whole responds to the solar action displayed in sun spots. There can scarcely be any doubt that the connection long since indicated by Sabine between the phenomena of terrestrial magnetism and the condition of the sun's surface with respect to spots is a real one. Not magnetic relations simply, but others which have only been associated within recent times with magnetism, as the occurrence of auroral displays, &c., have been clearly associated with the general condition of the sun's surface on the one hand, and with the outbreak of specific sun spots on the other. True, the great solar storms recognised, when mighty masses of glowing gas have been flung forth in the form of prominences, have occurred without any simultaneous auroral or magnetic disturbances on the earth. But these are side issues, literally. The solar energy is there directed not towards the earth, but at a right angle or thereabouts with her direction; and we can hardly wonder if she does not respond to these solar asides. Whenever the face of the sun turned towards her has shown evidence of perturbation she has responded quickly enough. The disturbance of September, 1859, was answered by movements of the magnetic needle at Kew, which, if not actually simultaneous, were so nearly so that the light of the sun itself reached us no quicker than the influence exciting that magnetic disturbance. Nor did the tremulous response of the perturbed earth last but for a moment. Throughout the night that followed Arctic and Antarctic auroral banners waved over the northern and southern hemispheres, being visible in latitudes seldom reached by such displays. For more than twenty-four hours, also, telegraphic communication was interrupted.

Again, it seems clear that the temperature of the earth, as a whole, is affected by the absence or presence of many spots on the sun's surface. This has been shown, apparently in an unmistakable way, by the underground thermometers at Edinburgh and at Greenwich. But the rain and wind cycles, the famine and financial crisis periods, the recurrence of disasters and shipwrecks, bad vine years, and so forth, in harmony with the sun spot waves—these have not yet been established. It sounds convincing when one cyclist notes that over a certain region the north-east winds are wetter and the south-west winds drier in sun-spotted times than when the sun is free from spots. Others find it still more convincing when some one else finds that in another region the reverse holds. And when it is further found that in some regions no such effects at all can be discerned, many find nothing disheartening in that. Still, it must be remembered that antecedently this sort of evidence was certain to be obtained whatever period had been dealt with; looking over a short range of time, one would be sure to find some places where the weather seemed to agree in one way with the period (any period whatever), other places where the weather seemed to agree in just the opposite way, and yet others where there seemed to be no agreement at all. And when we learn that as our survey ranges over time as well as over space, there appear similar diversities, the places which had seemed to agree one way or another no longer agreeing, it seems a little too much to ask men to believe that there is a real connection, but that while one place is affected one way, another is affected in the opposite way, and that as time passes, the effects vary. With such scope for difference and variation, a pack of cards, shuffled at random, might be shown to agree with weather cycles (red cards for fine weather, black ones for bad, or *vice versâ ad libitum*). Weather predictions guided by sun spots would be no better, in that case, than predictions based on coin-tossing as suggested by Sir Edmund Beckett.—*Times.*







SUN VIEWS OF THE EARTH;

OR, "THE SEASONS ILLUSTRATED."

By Richard A. Proctor.

I GIVE this week four views, showing the aspect of the earth as seen from the sun at 6 a.m., mid-day, 6 p.m., and midnight, Greenwich solar time. On the left of the column showing these sun views are given the Sun Views of the Earth for December 21, because, by an unfortunate mistake (for which I was partly, but not wholly, responsible), the pictures for that date were not correctly given in No. 63.

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SOME BOOKS ON ASTRONOMY.*

By Richard A. Proctor.

THE ideal book on general astronomy remains still to be written. Neither in the English nor in any other language is there a work on astronomy which presents a comprehensive view of that great science in such a way that every intelligent reader can appreciate the full beauty of the subject, while the truths of astronomy are correctly and sufficiently indicated. In saying this I reflect on no one—or, if on any, on very few—for, to the best of our knowledge, no one has ever attempted to do what, I here say, has not been done. Guillemin's "Le Ciel" comes nearest to such an attempt, and perhaps was intended as such—if so, the attempt unquestionably failed. But there are a number of excellent astronomical works directed to special ends, which must perhaps be accepted collectively, as all we shall ever have to teach the general public astronomy; for, such a work as we have suggested above would present so many difficulties, that I very much doubt if any writer will ever undertake the task; and certainly, however well the task might be done, other books on astronomy would be very much wanted by learners in different departments of the science. I know this as well as most men; for what I have written has usually been intended to meet such wants as I have experienced myself or as others have indicated to me—yet from a rough computation I find that what I have written in essays and papers, from the purely mathematical to the lightest and easiest, and published in books, on astronomy, amounts to more than three times the entire contents of the Old and New Testament. And so far was I from being impelled to this copious effusion of explanations and descriptions by *cacoëthes scribendi* and *copia verborum*, that my first essay was written at the rate of not more than ten lines a day (so difficult was composition to me), and my first book ("Saturn and its System," written in 1864-5) was more than a year in hand. In those days would go about with a whole chapter in my head, in my unwillingness to put pen to paper.

I have now before me several books on astronomy, not all recent, about which I wish to say a few words. They have been written to meet different wants, often expressed to me by correspondents; and, as I think they meet those wants exceedingly well, I mention them here, briefly and *seriatim*.

First comes that great collection of useful knowledge, Mr. Chambers' "Handbook of Descriptive Astronomy." (It suggests a rather large hand, but that is by the way.) This is a thoroughly honest book—like the others I have to touch on here. To say, as I have said elsewhere (and been rebuked for saying), that much of it is compiled, is to say that the author has acted fairly by his readers. Preserve us from an original treatise on astronomy—in a case such as this, where what we chiefly want is to learn the great headings of astronomy, not what A. B. or Y. Z. has to say about those headings! But a large portion of the work is original, too; and the amount of labour given to the book must have been simply enormous. It is no mere *façon de parler*, but the simple truth, to say that no astronomical library is complete without Chambers' "Descriptive Astronomy." Guillemin's "The Heavens" is an excellent work of the same kind, but less comprehensive. It would be, however, unfair of me to remark on the work as I have it, for I believe in later editions it has been considerably improved.

Next comes a work of a very different kind, one of the most remarkable and valuable books ever written on astronomy, and also one of the most original—Sir Ed. Beckett's "Astronomy Without Mathematics," which has just reached a seventh edition. I note first that the new edition has not only been most carefully revised, but parts have been re-written, while discoveries made since the sixth edition have been introduced here. Of the newly-written matter I must especially note that relating to the tides, on pp. 187-189. The whole subject of the tides is admirably dealt with.* If the reader remembers that this work is what its name implies, "Astronomy without Mathematics," not an "easy book of 'popular astronomy,'" he will recognise the admirable way in which it fulfils its plan and purpose. Sir Ed. Beckett set himself a very difficult task; he accomplished it like a master. The book is thoroughly good, from the first page to the last, though I may say of the author as he says of me (footnote, p. 69), "with some of his conclusions and opinions outside of ['Astronomy without'] Mathematics, I do not at all agree."

The next work is a recent and noteworthy contribution to the literature of Astronomy—Mr. Ledger's, "The Sun; its Planets and their Satellites." This work is the outcome of a course of lectures on the solar system read in Gresham College. The persons responsible for selecting the Gresham lecturer may be congratulated on having secured the services of such a zealous and faithful worker as Mr. Ledger. The book before us tells of much honest and careful labour. There is no silent appropriation of other men's labours, such as we sometimes see in such books; but while necessarily Mr. Ledger (like Mr. Chambers and other honest workers), has had occasion to refer freely to results obtained by others, there is an even superabundant record of indebtedness. Mr. Ledger deals with the Sun and Planets only, leaving to another volume the Stars, Comets, Meteors, and so forth. He investigates thoroughly nearly every question which comes before him, and not only so, but a number of matters of great interest to thoughtful readers, yet not relating to observed phenomena, such as the appearance and movements observable from other worlds. I wish I could from my own experience encourage him to persevere in dealing with matters thus outside of ordinary inquiry; but, as a matter of fact, it is astonishing how few can be persuaded to take the least interest in them. Thousands take interest in the perihelion-conjunction nonsense about the great planets; yet Mr. Ledger might with advantage have left out all that he says on this point. If he had given as many pages about the tides, for instance, it would have been as well, or a trifle better. There is no explanation of the tides at all. We note few errors in the book. But we are rather surprised to find Mr. Ledger, who shows considerable mathematical acumen, failing to correct that old blunder about Neptune and Uranus, which has misled so many writers on astronomy. He uses the old figure, first drawn, I think, by Lardner (who knew very little of mathematics), in which it was thought sufficient to connect Neptune and Uranus by an arrow-marked line pointing towards Neptune, and to say that that is the way in which the attraction of Neptune acted

* "A Handbook of Descriptive Astronomy." By G. F. Chambers. (Third Edition: Clarendon Press, Oxford.) "Astronomy without Mathematics." By Sir Edmund Beckett. (Seventh Edition: Society for Promoting Christian Knowledge, London.) "The Sun; its Planets, and their Satellites. By Edmund Ledger, M.A. (Edward Stanford, London.) "Rudimentary Astronomy." By Robert Main, late *Radcliffe Observer*. (Third Edition: Crosby, Lockwood, & Co., London.)

* On lines 13, 26, the reader should substitute "west" for "east." The correction is made by Sir E. Beckett himself, not by me. Very likely it would have escaped my notice.

on Uranus. Mr. Ledger does throw in a parenthetical remark to the effect that the real action is considerably more complicated; but this is not sufficient, especially as in a footnote he claims that the figure indicates "the direct or tangential effect of Neptune upon the velocity of Uranus." So far is this from being the case, that whereas the figure indicates accelerative action in 1781, the real action of Neptune at that time was retardative. Nor can I see that there is anything so very complicated in the determination of the real direction and magnitude of the perturbing force (for any simultaneous positions of the two planets), that a correct explanation should not be given, instead of one which is very simple indeed, but entirely wrong. However, this is a not very important matter. Speaking of Mr. Ledger's book generally, we may say that it is a thoroughly sound and useful treatise, well conceived and admirably illustrated. Printers, binders, and publishers, also, have done justice to the author. The book deserves success, and I have no doubt will have its deserts.

Main's "Rudimentary Astronomy," forming one of Weale's series, has long been known as a capital work for beginners; not that it is popular, but that it deals clearly and succinctly with the elementary principles of astronomy. The edition before us (the third) has been carefully revised and brought up to date by Mr. Lynn, formerly of the Government Observatory at Greenwich. There are a few errors still remaining. Thus the solar parallax is not, as represented at p. 83, the tangent, but the sine of the angle which the earth's semi-diameter would present at the sun's distance; and it is rather odd at this day to hear the size and mass of the earth adduced as evidence of special design for the adaptation of the globe we live on to its inhabitants. But the book may fairly be described as a sound and simple treatise on elementary astronomy, very carefully edited.

SYDNEY AND SUNDAY LECTURING.

I NOTICED in my last, among recent lecture experiences, an unwilling and luckily unsuccessful attempt to upset a Mayor. Some Australian papers, commenting on Sir Henry Parkes' recent rejection by his constituents, ascribe to me his nearly successful attempt to upset himself over one of my lectures. Misled by the "unco guid," Sir H. Parkes promulgated his decree against a Sunday lecture. Of the two who urged him to this course, one had known the interior of a gaol for watch stealing, which led to my remarking to the audience of some 2,000 persons who assembled at the Theatre Royal, Sydney, a few days later, how good it was of Parkes' adviser to keep a watch for me as well as for himself. The other was a zealot, who probably attributed to wicked science the sparseness of his own congregations. Be this as it may, it was generally agreed that Sir Henry hoped to increase the majority at his next election, which had been but fairly good at his last. It was supposed by many that my lecture was actually stopped by him. But so far as anything he could have done or said was concerned, that lecture—on the evil subject, "The Vastness of God's Universe"—would unquestionably have been delivered. The platform was ready; the theatre was open; the manager (Mr. Garner, the well-known actor) had agreed; my energetic agent, Mr. R. S. Smythe, had, like a Napoleon, marshalled all his forces; and at six, the lecturer (who needed rest after travel) was sleeping the sleep of the just tired out, in preparation for the lecture. That Sir Henry Parkes's police, if he had dared to send any to the theatre door, would have done more than advise us not to oppose his unlawful interference, no one who remembers the crowd that was assembled will for one moment believe. (I certainly addressed not fewer than five (many said ten) thousand from my hotel window soon after, and if I had chosen to excite further, instead of doing my best to allay their just wrath, they would have been ready to do something more than merely resist a few, or even a few hundred, policemen. Why, then, was the lecture not given? Simply because it was shown to my satisfaction that not I, but another, would have suffered, had I delivered it. The lessee, Mr. Lazar, was warned that whether the law was with us or against us, his theatre could be closed (if the lecture were given) till the question was settled,—that is for months. I should not have lost a penny by this, nor would the London Comedy Company have lost much, as they could have gone elsewhere, and perhaps had their remedy for loss of time. But Mr. Lazar would have lost a great deal, and the people of Sydney would have lost much good acting. While the lessee appealed to Mr. Smythe, and Mr. Smythe (waking me from sweet sleep for the purpose) appealed to me, I had no choice (unless I had had as little conscience as Sir H. Parkes in the matter) but to accept, as I then thought, loss myself, rather than bring a much greater loss on another. So late was Mr. Lazar's appeal made, and my decision taken, that there was no time to give the necessary notice, and we narrowly escaped an awful row in consequence. It will be judged how much our decision was brought about by Parkes, who had been all the previous week threatening Mr. Smythe and myself. His people had alarmed Garner, but Garner had come round most manfully. On us—who knew how illegal his whole course was, and that *he* knew it too, for the Attorney-General had told him—he had produced simply no effect at all.

He barely scraped through at the next election, and I see several colonial papers ascribe the loss of votes to his interference with me. It is likely enough. All the papers took my side, and at the enormous gathering on the Thursday following at the Theatre Royal, a very strong feeling of contempt for him and his advisers was manifested in an unmistakable fashion. Then, too, the first fruits of his action were noticed as they affected myself. What I had supposed a loss turned out a very great gain. Elsewhere, as well as at Sydney, the papers took my part most warmly and generously. While I cannot say I hear with regret that Sir Henry Parkes has been rejected—for one who breaks, or at least fails to recognise, the law, is not fit to be among those who administer it—I must admit his being Secretary of State when I visited Sydney was a most lucky thing for myself, as matters turned out for me. As in the case of my criticisms on Sir George Airy's inexact first papers on the transit of Venus, so here,—what I did as a duty, by which I should probably lose, turned out very much to my advantage in the end. I owe all my pleasant experiences in America and Australasia, indirectly, to the one—the very pleasantest and brightest of those experiences directly to the other.—RICHARD A. PROCTOR.

THE Turkish railroads have some peculiar freights. The Roumelian line from Constantinople north-westward, in its last fiscal year, carried 5,741 tons of essence of roses, valued at about 320,000 dollars. It also carried 1,500,000 melons to Constantinople, but probably, says the *Railroad Gazette*, some of our Southern roads can match that. On the line in Asia Minor, leading articles of freight are Angora goat-hair and meerschaum.

Our Paradox Corner.

IS IT POSSIBLE TO GROW GIANTS?

[On the staff of the *New York Times* there is a humorous writer who from time to time throws off a leader dealing with some quaint quasi-scientific notion, blandly quoting Mill, Darwin, Huxley, Spencer, Tyndall, and others (including the Editor of KNOWLEDGE), in pretended support of his odd fancies. The following amusing squib is from the pen of this clever writer, though sent to us as a scientific communication over the name of the *Medical Press and Circular*.—R. A. P.]

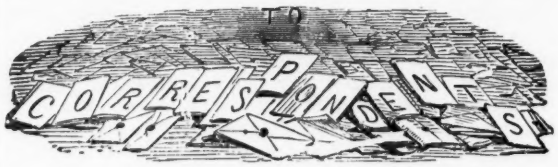
THIS question has received almost a solution. According to the *New York Times*, "the incubator of M. Tarnier has succeeded in raising infants who, at the end of six months, weigh 84 lb., and whose weight at birth six months previously was only 10 or 12 lb. The incubator of M. Tarnier is framed on the model of the one for hatching eggs scientifically. The immense success which attended the artificial incubation of chickens in France attracted the attention of the learned, ingenious, and obstetric physician. He was attached to a hospital for foundlings, and although the position gave him an admirable opportunity for experimenting with new medicines, he was a humane man, and he was annoyed at the large number of foundlings who died within the first six months of their life. The majority of those admitted to the hospital were weak and sickly, but in that respect they did not differ from all sorts of French infants. Dr. Tarnier felt that it was a reproach to medical science that French infants could not be cultivated with as much success as French chickens, and he resolved to try what artificial incubation, if it so may be called, would accomplish if applied to infants.

"The doctor constructed a child-incubator on precisely the model of the ordinary chicken-incubator. It was a box, covered with a glass side, furnished with a soft woollen bed, and kept at a temperature of 85 degrees Fah. by the aid of hot water. He selected as the subject of his first experiment a miserably-made infant—one, in fact, that had rashly insisted upon beginning the world at an injudiciously early period. This infant was placed in the incubator, provided with a nursing bottle, and kept in a dark room. To the surprise of the doctor, he ceased to cry on the second day after he was placed in the incubator, and although it had previously been a preternaturally sleepless child, it sank into a quiet, deep sleep. The child remained in the incubator for about eight weeks, during which time it never once cried, and never remained awake except when taking nourishment. It grew rapidly, and when, at the expiration of sixty days, it was removed from the incubator, it presented the appearance of a healthy child of a year old. Delighted with the success of this experiment, Dr. Tarnier next selected an ordinary six months old infant, addicted to the usual pains and colic, and exhibiting the usual fretfulness of French infants. The child conducted itself while in the incubator precisely as its predecessor had done. It never cried; it spent its whole time in sleep; and it grew as if it had made up its mind to embrace the career of a professional giant. After six weeks' stay in the incubator, it was removed and weighed. During this brief period it had doubled its weight. It had become so strong and healthy that it resembled a child three years old, and it could actually walk when holding on to a convenient piece of furniture.

"These two experiments satisfied Dr. Tarnier of the vast advantages of artificial child-incubation. He immediately proceeded, with the permission of the authorities of the hospital, to construct an incubator of the capacity of 400 children, and in this he placed every one of the 360 infants who were in the hospital on the 10th day of February last. With the exception of one who died from congenital hydrocephalus, and another who was claimed by its repentant parents, the infants were kept continuously in the incubator for six months, when they were removed in consequence of having outgrown their narrow beds. The result will seem almost incredible to persons who are unfamiliar with the reputation of Dr. Tarnier, and have not seen the report made to the French Government by a select committee of twelve.

"The average age of the infants last February was eight months and three days, the youngest being less than twelve hours old, and the eldest not more than eleven months. Their average weight was 10 lb., only one of the entire 360 having attained a weight of 32 lb. At the end of six months of artificial incubation the average weight of each infant was 84 lb., and there was not one who would not have been supposed by a casual observer to be at least eight years old. In other wards, six months of artificial incubation did as much in the way of developing Dr. Tarnier's foundlings as eight years of ordinary life would have done. The infants were strong and healthy, as well as big; they walked within a week of leaving the incubator, and most of them have since learnt to talk. These results surpassed Dr. Tarnier's most enthusiastic expectations, and there can be no doubt that his system of artificial child-incubation will be adopted, not only in every child's hospital in France, but in every private family throughout the civilised world."

We must make allowances [rather!] [proceeds the *Medical Press*, and truly "it will go near to be thought so, shortly"] for some of the statements, which are taken from an American paper. Allowing for exaggerations, the incubator of Tarnier may be of use in rearing delicate and premature infants. It is an ingenious application of a principle recognised by agriculturists.



"Let Knowledge grow from more to more."—ALFRED TENNYSON.

Letters to the Editor.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the EDITOR OF KNOWLEDGE; *all Business communications to the* PUBLISHERS, *at the Office, 74, Great Queen-street, W.C.* IF THIS IS NOT ATTENDED TO, DELAYS ARISE FOR WHICH THE EDITOR IS NOT RESPONSIBLE.

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The Editor is not responsible for the opinions of correspondents.

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STAYS AND STATUES.

[693]—Supposing that "An Observer" is a male, I really must thank him, on behalf of my sex, for his very high opinion of our common sense. He says that because Dr. Lewis has stated as a fact that in America "a waist of 19 in. is considered immense, while here it is considered rather small," therefore English women will be induced to order smaller stays than ever. He may ease his mind. I really don't think it is at all probable; if American women are so foolish, I see no reason why English women should be. Again, after quoting Dr. Lewis's letter to the effect that "in America a reduction of 10 in. is common, against 7 in. or 8 in. here," "An Observer" remarks that therefore waists of only 14 in. must be common there. This is mere quibbling. Every physiologist knows that a waist of 19 in. can only belong *naturally* either to a person reduced to a skeleton or to one very much under-sized. And of course Dr. Lewis means that a person whose waist would normally be 29 in. has reduced it to 19 in. This is an extreme case, though quite possible. Few people can grasp the idea of the marvellous compressibility of the waist. I know a young woman who as a girl had a waist of 26 in.; it is now 20 in., and this wonderful change took place in a little over a year. I need scarcely remark that she is far from being a healthy person.

After stating that he has inferred (with great acuteness) from Dr. Lewis, that waists of 14 in. are common in America, "An Observer" says that (as a corollary from this), he is "more incredulous than ever of any bad effects from such tight-lacing as is practised here now." Really, "An Observer" must have a unique mind. He acknowledges the compressibility of the waist, the length to which women are prepared to go, and therefore thinks that tight-lacing can do no harm! Why does he suppose our waists are made the size they are? What does he suppose happens during the cultivation of a waist? "An Observer" has evidently no notion either of anatomy or physiology, and I think it would be advisable if such people left the subject of tight-lacing alone.

Again "An Observer" says: "And as for 'a third of women's diseases coming from it' (tight-lacing), how do the doctors, who write in this loose way account for women living on the average some years longer than men?" I need hardly remark that statistics are, of all things, the most misleading. I question whether women do live longer than men; but whether they do or do not, they certainly ought to, looking at the circumstances of their daily life. Are women soldiers, sailors, sappers, miners, navvies, or railway servants? How many deaths are annually reported owing to accidents to such persons? Are women exposed to much danger in any of their daily occupations? Deaths arising from brain work

are also far more common among men than women, as we might naturally suppose, but I fancy that more women die a so-called "natural" death (though I should like to dispute the term as applied to many deaths) than men. Were women, in the dress they now wear, to pursue the same avocations as men, I imagine that the mortality among them would be far greater than among men. Again, women on the whole are more temperate than men, and therefore ought to live longer.

"An Observer" says "that it is useless to ignore the fact that they (exercises) never are or will be practised beyond a certain age, if at all."

I admit, with grief, that this was so in our mothers' and grandmothers' time, but as to the future—is "An Observer" a prophet, that he should speak so positively about it? Judging from what I have heard the elder generation say, and from books generally, I should think that the tendency was in exactly the reverse direction. Girls and women take far more exercise now than formerly, and the more they are released from the trammels of dress, the more still will they take. As far as my experience goes, girls are only too glad to get exercise, but none of their schools in this country provide it.

I should be sorry to take quite such a pessimistic view of society as "An Observer." He appears to think that because a thing is, never mind how bad or foolish, therefore it must be,—as in the matter of exercise, and later, in a part of the letter on which I do not propose to touch, inasmuch as it concerns the Editor, and he will probably refer to it in his forthcoming article, viz., the passage to the effect that since all civilised nations consider slender waists handsome, therefore "they are quite certain to be cultivated artificially." Again I question this prophetic utterance; again the tendency seems to me to be in exactly the reverse direction—see the High Art Movement, the Dress Reform Association, and Ladies' Sanitary Association. Whereas four years ago I hardly knew a person who did not wear stays, now I know over a hundred, and many of these have only left them off of late years.

In conclusion, I think that if "An Observer" would peruse a certain little book entitled "Dress and Health," he would see that comparing tight-lacing to "the notoriously painful and destructive maiming of Chinese feet" is *not* ridiculous; and also that a "little silence" on his part concerning this subject would have been more prudent. G. C. S.

THE COMET.

[694]—Can you find a corner for some of the most elementary notes and questions about the grand comet we are all admiring? Here in India we have from our clearer skies almost unequalled opportunities for observation, had we only the means and the leisure. As it is, the only well-fitted observatory is in Madras, and there at this season the sky is often as cloudy and unfavourable as in dear old England itself. In fact, the notes from the astronomer there stated that the comet had been observed there on 12th Sept., a fact which appears not to have been brought to your notice, but that in consequence of unfavourable weather he had not been able to make another observation until the 20th or 21st. It is interesting to note that the Government Astronomer states that the first news of where the comet should be sought was given him by the captain of a vessel which put in at Madras. Probably, therefore, valuable information as to its first appearance and the earliest observations of it may be got from the logs of homeward-bound ships.

Here, in lat. 30° long. 69°, I first noticed the comet at about 5·45 a.m. on Saturday, 22nd September. It was then just paling in the morning light. This was the first time the comet had been seen by the people themselves, for I made inquiries of the police, whose duties keep (or ought to keep) them awake all night. The country people undoubtedly regard its appearance as portentous, and refer back to the disastrous days of 1858 for its parallel. It may amuse you to know that their unpoetic nickname for it is "the Broom (jhārū)"!

On the following morning I had a view of his wonderful beauty, first seeing him when his tail was half only above the horizon, and I shall never forget the impression made on me. It showed like a vast sheet of flame, due magnetic east, and was so bright that I could scarcely believe it was not the flame of some great fire in the distance. At that time, and every day since (don't you in foggy England envy us our opportunities?) I have risen to have a good look at it, the only better or worse of the conditions being the greater or less brightness and nearness of the moon and the later rising of the sun, with the increasing apparent distance of the comet from the sun. I am writing now at 5·45 a.m. Madras time (which is about 36 minutes in advance of local mean time), and the moon is in the zenith of a perfectly cloudless sky. The comet bears about S.E., the nucleus being about 30° above the horizon. When first observed by me, and for several days after, the tail appeared almost bifurcate, having a distinct ovoid space between the two tails, but latterly the two have seemed to combine, and that to the apparent zenith to be considerably longer and more taper than the other. It swept through about 12° of sky, but appears to be gradually but slowly decreasing in size. The Madras observations pointed to the conclusion that the comet had passed his perihelion, and was going away from the sun with rapidity.

Now, may I ask a few very ignorant questions?

1. How comes it that such a magnificent visitor to the sky should escape notice from the observatories scattered all over the world—if, as I suppose, he was gradually increasing in brightness up to perihelion, and not very much further from the sun to the observer on the earth? [The comet might have been visible long before it was, if it had been as bright during approach as during recession, but the circumstances were less favourable, the comet being in the same part of the celestial sphere as the sun.—R. P.]

2. How is it that he should not have been seen about midnight in the longitude of Greenwich when he was seen here 70° E. long., at 5 a.m. local mean time? [Because he was then below the horizon of Greenwich.—R. P.] I am, AN ADMIRER.

Mooltan, India, *Nov.* 1.

SUN-VIEWS OF THE EARTH.—SPELLING OF MISLETOE.—A NEW ZEALAND GUM.

[695]—Allow me to thank you for your beautiful "sun-views of the earth" in this week's KNOWLEDGE. They will make splendid diagrams for teaching-purposes when enlarged. It is a pity that, through some oversight, the lettering and arrangement of the four views are wrong. No. 3 should stand first, and be marked "At 6 A.M.," while the top one should take its place and be marked "At 6 P.M." You have, no doubt, discovered the error before now; but it will be rather puzzling to young students who try to trace the earth through its daily course. The fifth view is very effective (see pictures in the present number).

There is no doubt that the spelling "misteltoe" is the most correct according to etymology; but the sound of the "t" having been dropped in pronunciation, there is a tendency (a healthy one, I think) to omit it in the spelling. The history of the word is most peculiar and interesting, and illustrates a point in Mr. Clodd's article on Myths. The word in Anglo-Saxon is *mistletan*, *tan* meaning twig. *Mistel* is from A.-S. *mist*—mist, fine rain, which in Old Dutch had the sense of glue or birdlime, and in German that of dung. The sense is, therefore, "birdlime-twig" (Skeat). But we may trace the word *mist* a little further, and see its connection with the Latin *mingere*, Dutch *mijgen*, A.-S. *migan*, all meaning to void urine (hence the connection with the German *mistel*, dung), and may imagine our remote and childlike forefathers referring mist and rain to the watery excretions of the gods.

The fossil gum referred to by Mr. Clark (685, p. 27) is a resinous exudation from the bark of the Kauri pine of New Zealand (*Dammara Australis*), growing specimens of which are in the Temperate House at Kew. Dr. Hooker says, "the bark is thick, yielding tears of resin in great profusion; enormous masses of a similar resin, many pounds in weight, are found in the soil in many places, far from where these trees now grow, and are presumed to have the same origin." This resin has been prepared and advertised for microscopical purposes, under the name of "gum dammar."

Best wishes for the success of KNOWLEDGE, which supplies a great want, in a bold yet considerate manner. WM. FIELD.

ELECTRICITY AND DENTISTRY.

[696]—About twenty-five years ago there was such a craze for extracting teeth by electricity, that, for a time, the makers of batteries were hardly able to meet the demand for them. I was then engaged in the dental practice of one of our large hospitals, and I determined to test the merits of the invention there. In the first experiment a patient was selected for whom it was necessary to extract two corresponding, and therefore similar, teeth. The first tooth was extracted in the ordinary way; but for the second, the electric apparatus was adjusted, and much interest was naturally taken by those present to watch the result of the new process. When the tooth was removed, the patient immediately exclaimed that the pain was nothing to be compared with the other tooth. This seemed decidedly in favour of the electricity, until, upon examining the battery, I found that the connecting wires had been coupled in such a way that it could not, by any possibility, have acted at all.

This case proved nothing as far as the electricity was concerned, but it illustrated what is often an important factor in such cases, viz., the power of a strong faith in the efficacy of the means employed. Other experiments all tended to prove that there was no

real benefit to be obtained from it, and no effect at all, except what was easily to be accounted for by the temperament of the patient. I think the explanation of cases in which it is stated that painless dental operations have been performed without anæsthetics is, that in anticipation the pain is always exaggerated, and when some mysterious agency is employed, it, of course, gets the credit of causing the unexpectedly small amount actually endured.

N. Stevenson.

A LOGICAL PUZZLE.

[697]—Perhaps the high numbers you chose for the illustration of this subject may account in some measure for the difficulty which some of your readers still experience in regard to it.

The problem is:—

(1) For every Z there is an X which is not Y.
(2) Some Y's are Z's.
∴ Some X's are not Z's.

Suppose there are 10 Z's. Then, by the first premiss, there will be ten or more not-Y X's. Now, a thing cannot be Y and not-Y X at the same time; therefore, if, by the second premiss, *even one* Z is a Y, there are only nine left, which by any possibility can be not-Y X's; but there are ten or more of the latter; therefore, *at least one* not-Y X cannot be a Z. R. R.

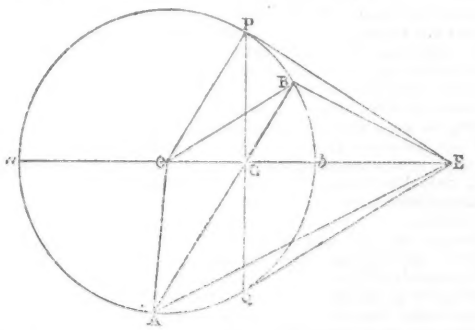
Answers to Correspondents.

H. J. Bowyer. No; Jupiter. Venus not only visible, but splendid, in the eastern skies before sunrise.—Tycho. My advice would be to look out for advertisements of a second-hand telescope. But whatever you might get from either of the makers you mention, would be good value for your money, and would always command a good price if you wanted to sell again.—E. C. C. (1) Molecular movements exciting ethereal undulations, I suppose. (2) For a time must, in response to other readers, have a little of the more elementary mathematics.—F. Rogers. Sorry that your notice arrived so late. On Jan. 10, when it came, Knowledge was already in the press.—A Young Man. Your dream was noteworthy. "Only a new-comer!" That is what science tells each of us.—Peccavi. The idea has been suggested before, but we have little spare space. Thanks for pleasant note.—T. R. Allinson. Do not wish to discuss that as part of the corset question. The fooleries of fashion are outside "An Observer's" argument, and not worthy of attack, *per se*, from our side.—Algol. When I wrote that it had been but recently noticed that γ Cassiopeiæ is variable. (2) The colour of Arcturus is variously estimated. I have seen it named among the red stars; also among the orange; to me it seems orange yellow; others think it simply yellow; you find it sulphur yellow. (3) In some of those ridiculous books on Astrology, by Zadkiel (Lt. Morrison), Raphael (Thomas Blodkins), Uriel (Jacob Plugwinkle), and others—to be picked up on bookstalls—you will find the stars of evil influence.—Aurora. We do not usually give advice; but where the symptoms are so very clear we "break through a rule to oblige an old friend" (as you seem to be from your reference to far back numbers). For your complaint, the pills known as Cockles' Antibilious ones are invaluable.—W. Grandy. Have no lecture engagements at Southampton. Oddly enough, your kindly letter came immediately after the most atrabilious one we have read for a long time. Nine-tenths of our letters, now, however, are of the pleasantest tone.—A. C. Morasso. Probably the volumes will be half-yearly. As you say, they will be much more convenient.—Canadensis. I think difference of temperature, and, consequently, of moisture, in those parts of the ceiling, account for that peculiarity.—R. H. Simpson. Cannot well look out gossip notes in Knowledge for readers.—Lieutenant. The question was entered into rather fully in early numbers. Ice-boats undoubtedly do travel in many cases much faster than the wind which drives them. You reason out the matter quite correctly. But I think the relative velocity is never quite so great as you suggest (five or six times the wind's).—R. L. Nichols. Our article touched on the principle laid down by Baron Huddleston, not on the evidence.—J. M. Crombie. We hope to use the article shortly.—E. P. Sells. Many thanks. Auroras not probably due to comet, even indirectly; though possibly it may have brushed up the solar surroundings in such sort that the earth's magnetic condition was affected.—J. A. S. On re-examining the question I see that other solar eclipses may possibly be visible in England before 2090,—but none satisfactorily.—Upsala. (1) Eccentricity and ellipticity are different matters; it was the latter I wanted, and you give me the former. (2) Cannot a line be drawn from a station to Venus and produced to the sun's surface without your proclaiming that the produced line is an illusion? If one, why not two or more? What occasion for Venus to be a lens?—J. Peschule. "Miss Edwards an American!" What can have suggested such an idea to you? Not to know one so widely known as a novelist and an Egyptologist argues yourself unknown.—Z. Perhaps I go as far as you do; but one must not go too far ahead of the main body. We are in the "forlorn hope" as it is.—E. P. Sells. Thanks. We could hardly have our "Face of the Sky" shown five or six weeks ahead. Subscribers here would find it inconvenient; and they necessarily form the great body of our constituents.—A. Lout, M.A. Thanks for the information that watches do not "consume" their glasses. "It will go near to be thought so, shortly." It is also true, whatever trade announcements may affirm, that lead is never "lively," brandy "dull," nor potatoes "flat," and so forth. Yet, though I have noticed these things, it has not occurred to me to write to the editors of business papers explaining as much. If I were capable of such an absurdity, I might perhaps be also capable of perpetrating it in the particularly offensive manner you adopt for yours. "In Heaven's name," you say, "buy a sixpenny dictionary and keep it beside you!" I would commend to your attention the cheapness of certain little books on manners.—F. H. I cannot think your way of treating the Corset question as scientific in substance as in form. You assume, contrary to all evidence, that the tendency, as civilisation advances, is towards increase of ornament, and of those artificial ways of treating the body of which corset-wearing is but one. Compare the fashions of the middle ages with those of two centuries ago, and these in turn with the fashions of our own time, and you will find there has been a steady progress towards simpler and more sensible attire; though, unfortunately, there is still ample room for improvement, especially in feminine costumes. In some of Froissart's pictures you see all the ladies as absurdly pinched about the waist as nowadays only the silliest are. I fancy there is more absurdly tight lacing now among servant-girls out for a holiday than among ladies.

Our Mathematical Column.

TO DETERMINE THE ATTRACTION OF A SPHERICAL SHELL ON AN EXTERNAL PARTICLE.

Let a P b Q *be a spherical shell of radius* r, *of thin uniform section* r, *and of uniform density* ρ; O *its centre*, E *an external particle*; O E = d. *It is required to determine the attraction of the shell* P Q a *on the sphere* E.



Draw $a\,O\,b\,E$; tangents E P, E Q; P G Q cutting A O E in G. Draw any chord, A G B, through G; and join O P, B E, O B, O A, and A E. Then, since O P E is a right angle,

$$OG.GE = PG^2 = b\,G.G\,A$$

Therefore, a circle will pass through the points A O B E. Hence, since chord O A of this circle = chord O B, ∠ O E B = ∠ O E A; and B E : E A :: B G : G A.

Now, if we suppose a conical surface of minute vertical angle 2ϕ to have its vertex at G; it is obvious that the elliptical sections of the sphere at B and A being inclined at equal angles (equal to the angle O B A) to the axis, have areas proportioned to the squares of G B, G A. Hence, since their attractions on particle at E are directly proportional to the mass, that is, to the squares of G B, G A, and inversely proportional to squares of B E, E A, that is, of G B, G A, these attractions are equal, and their resultant acts in direction of E O, the bisector of the angle B E A.

Now, noting that triangle G B E is obviously similar to triangle

AOE (for ∠ GBE = ∠ AOE, and ∠ BEG = ∠ OEA), we see that the resolved part along EO of the attraction of small elliptical section at B on particle at E = $\mu \times$ its mass $\times \cos BEO \div (BE)^2 = \mu\rho r\pi$ (GB) $2\phi^2$ sec OBG $\cos BEO \div (BE)^2$, where μ represents the attraction of a unit of mass at a unit of distance; and since OBG = BEO, while

$$GB : BE = OA : OE = r : d$$

attraction of element at B on particle at E = $\frac{\mu\rho r\pi\phi^2 r^2}{d^2}$, in direction EO.

In other words, it is the same as though there were a spherical shell, of radius r and thickness r, around G as centre, and the element of this shell intercepted by conical surface having vertex at G and small vertical angle 2ϕ, were transferred to O.

The same may be proved of the resolved part of attraction of element at A on particle at E, in direction EO. The resolved parts of the attractions of elements at B and A, at right angles to EO, are equal and opposite, and need not, therefore, be considered.

This being true of all such sections as we have supposed at B and A, is true for the whole spherical shell,—which, therefore, attracts the particle E, as if the whole mass of the shell were at O.

COR.—*As a homogeneous sphere, or a sphere whose density varies according to any law with the distance from the centre, may be supposed made up of an indefinitely great number of concentric shells of small thickness and uniform density, it follows that the resultant attraction of a sphere of either kind on an exterior particle is the same as though the whole mass of the sphere were collected at the centre.*

Our Chess Column.

BY MEPHISTO.

THE following game, which was recently played, will be found to contain interesting positions for study :—

VIENNA OPENING.

White. Mephisto.	Black. H. E. Bird.
1. P to K4	P to K4
2. Kt to QB3 (*a*)	B to B4 (*b*)
3. P to B4	P to Q3
4. Kt to B3	Kt to QB3
5. B to Kt5	B to Q2 (*c*)
6. P to Q3	Kt to B3
7. B takes Kt	B takes B
8. P takes P	P takes P
9. Kt takes P (*d*)	Q to Q5 (*e*)
10. Kt to Kt 4	Kt takes Kt
11. Q takes Kt	Castles KR (*f*)
12. R to B sq (*g*)	P to B4 (*h*)
13. Q to Kt3 (*i*)	P takes P
14. B to B4 (*j*)	

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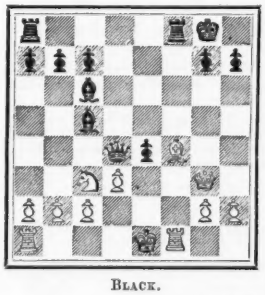

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	R takes B (*k*)
15. R takes R	B to Q3
16. Q to B2	Q to Kt5
17. Castles (*l*)	P to K6 (*m*)
18. R takes Q (*n*)	P takes Q (*o*)
19. R to K4 (*p*)	R to KB sq
20. R to B sq	B takes P (*q*)
21. R to K2	B to Kt6
22. Kt to K4	B takes Kt
23. R takes B	P to KR4
24. K to Q2	K to R2
25. K to K2	P to R5

White. Mephisto.	Black. H. E. Bird.
26. R to KR sq. (*r*)	P to KKt4
27. R to K6 (*s*)	R to B4
28. K to B sq (*t*)	K to Kt2
29. R to R3	K to B2
30. R to K3	R to Kt4 (*u*)
31. P to Kt3	R to R4
32. P to R4	P to Kt4

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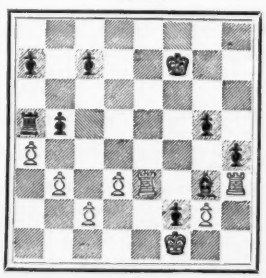

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33. R takes B (*v*)	P takes R
34. R takes P	P takes P
35. P takes P	K to Kt3
36. R to Kt4	K to R4
37. R to QB4	P to Kt5
38. K takes P	K to R5
39. P to Kt3 (ch)	K to R6 (*w*)
40. R to B4	R to QB4
41. P to B4	R to KR4
42. R to B7	R to R sq (*x*)
43. P to Q4	K to R7
44. P to Q5	R to R6
45. P to B5	R to R3 (*y*)
46. P to Q6	P takes P
47. P takes P	K to R8 (*z*)
48. P to Q7	R to R7 (ch)
49. K to B sq	R to R sq
50 P queens	Resigns

NOTES.

(*a*) Safer than the King's Knight's Gambit.

(*b*) Admissible; cautious players, however, prefer Kt to QB3.

(*c*) Best. In this position it is not uncommon for players to drop into a bad variation by playing instead—

5.	Kt to B3	7. B takes Kt	P takes B.
6. P to Q 3	Castles	8. Kt to QR4	

Threatening Kt takes B, which will either triple the Pawns on the Bishop's file or win the King's Pawn.

(*d*) A dangerous capture, therefore not advisable.

(*e*) Initiating a strong attack.

(*f*) A very good move, and better than 11. Q to B 7 (ch), for after 12. K to Q sq. Castles; 13. Q to B3, Black's chance of attack is diminished.

(*g*) In consequence of Black's good play the position is full of difficulties. Black threatens the dangerous move of P to B4, and thereby to open up the KB file for his King's Rook, or even the K's file for his Queen's Rook, which would be fatal. The only other possible move seems to be Kt to K2, which, however, would also result badly, *i.e.*, 12. Kt to K2, Q to B7 (ch). 13. K to Q sq, P to B4 (if Q retires P takes P with advantage). 14. P takes P, Q takes KtP, and Black must win the exchange by 15. Q takes Q, B takes Q. 16. R to K sq, B to B7.

(*h*) Brave, and destroys White's hopes for peace and quietness. Watch the following ingenious combination:—If in reply to P to B4. 13. R takes P, B to Q2! 14. R takes R, R takes R, now White's Queen is attacked and Black also threatens check with the Queen followed by the Rook, which must result fatally. For instance, if 15. Q to Kt 5 (apparently his best), then follows Q to B7 (ch). 16. K to Q sq, Q to B 8 (ch). 17. K to Q 2, R to B 7 (ch), and mate in two moves.

(*i*) White of course expected an attack when he ventured on 9. Kt takes P, but when there is an attack there is also a defence. This move must be taken in connection with the following one as being the soundest reply.

(*j*) If now P takes P, then Castles, White will recover his Pawn, and turn a dangerous position into one of comparative safety.

(*k*) Black was not justified in trying to overcome White's tenacity by such impatient means; he might still have retained a good game by the following play:—14. P takes P. 15. Castles, B to Q3 (best). 16. B takes B (forced), P to Q7 (ch). 17. K to Kt sq. P takes B, and Black has the better game.

(*l*) The best way of meeting Black's attack; had White attempted to preserve his Rook, then Q takes KtP would had involved him in difficulties.

(*m*) A fine specimen of Black's noted brilliancy. If B takes R, 18. Q takes B, and White stands somewhat better.

(*n*) The only move to avoid loss.

(*o*) We can now better point out Black's plans, and why he did not take the Rook. He now threatens the Rook as well as B takes KtP. If to prevent this White plays 19. R to KKt4, then follows R to KB sq. 20. R to B sq, P to KR4. 21. R to Kt6, K to R2. 22. R takes B (best), B takes KtP (best). 23. R takes P (best), R takes R. 24. R to Q7, B to B3. 25. R takes BP, R takes RP, and Black has two passed Pawns.

(*p*) The right move; it avoids all danger, and if Black takes the Rook, White remains with a fair ending of Knight against Bishop.

(*q*) Although B takes R was sound play, we cannot condemn this bold move, because with the Pawn on B7, Black could fairly reckon upon drawing the game, but it also left him a (very) remote chance of winning. Had he played B takes R he would have had nothing left but to play for a draw.

(*r*) The ensuing ending is most interesting. White must now endeavour to utilize his advantage—by no means an easy task. R to R sq is the beginning of a series of moves to arrive at a favourable position to sacrifice a Rook for the Bishop with advantage.

(*s*) A most important move, as it cuts off the King from the Bishop and wins time ultimately. If White takes the Bishop (the only way of winning) he would lose unless he could also get some Pawns. There would be no hope of doing this if the King were near the Bishop.

(*t*) To render the Rook on R sq available.

(*u*) As will be seen, this and the following moves force White's hands, as Black obviously threatens to break through White's Pawns. It would, of course, not have been good to play R takes B now, for Black threatens to play havoc amongst White's Pawns.

(*v*) An opportune moment, and promising the utmost possible advantage.

(*w*) Black has shown all along that he disdains to play for a draw, but the move in the text positively loses.

(*x*) "Hope springs eternal in the human breast." If 43. R takes P, then R to B sq (ch), followed by K takes P.

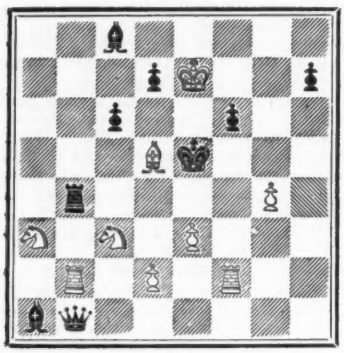
(*y*) If R takes P. 46. R to R7 (ch), R to R6. 47. R takes R, K takes R. 48. K to Kt sq, and wins.

(*z*) Black obviously cannot take the Pawn, on account of R to R7 (ch).

DOUBLE FIRST PRIZE PROBLEM IN CHESS MONTHLY TOURNAMENT.

By A. Cyril Pearson.

Black.



White.

White to play and mate in four moves.
Key move QKt to Kt5.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

John Lonsdale.—A problem may begin with a check. The solutions of such problems are, of course, thereby rendered more obvious. There is no objection to moving the King as first move; some very fine problems have been composed on that line.

Francis J. Drake.—Solutions correct.

Herbert Jacobs.—Problem received with thanks.

Clarence.—Our own fault, not printer's. Cows' tails and mathematics out of our line.

X. X. X.—We draw the line at three moves; cannot see it.

Correct solutions received.—Problem No. 67, East Marden. Nos. 68 and 69, East Marden, W. Rees. No. 71, Clarence, John Lonsdale, John, John Simpson, H. V. T., R. J. P., W., Berrow, John Watson.

Correction.—We regret to say Problem No. 70 admits of two solutions, by Kt to Kt3 (ch) or Kt to Q3 (ch.)

Our Whist Column.

By "Five of Clubs."

CONDUCT OF THE HAND.

(*Continued from page* 29.)

SIMILAR considerations lead to what is called *underplay*, which is usually adopted in order to gain command of a suit. For instance, if after one round of a suit has been played, you know that the second best card of the suit is held by your adversary on the left, while you hold best and fourth best, then, when trumps are out, or if the suit be trumps, you do well to lead a small card of the suit. Second hand will hold up the second best, believing the king-card to be on his left, and your partner, if he has it, will win with the third best. You then have the command, probably the full command, of the suit.

Another form of underplay, and one which is of such frequent occurrence as to require special notice, is the holding up of the winning card at the second round of a suit. In plain suits this is not usually advisable, unless either trumps are out or there is a good prospect of quickly getting them out. But in trumps or in plain suits after trumps are out, it is often well to let the second trick pass, that with the third trick you may get in. Not only is it much more important, as a rule, to win the third than the second round of a suit, but by holding up the winning card you may give your partner a chance of making the third best. Thus, say that in the first round of your strong suit, Hearts, there have fallen, Seven (your lead), Queen, Ace, Five, and you remain with King, Nine, Six, Four. The suit is changed, and presently trumps are exhausted. Later your right-hand adversary leads Three of Hearts, though your strength. If you now play the King, the third round will most probably go to the enemy; for your partner certainly has not the Knave. But if you play the four there is a chance that you may find third hand weak, and that your partner may take with the Ten. If this does not happen, and third hand wins, whether with Ten or Queen, the probability is that in the third round, won by your King, the other card above your Nine will fall, in which case you make two more tricks in the suit.

So it is often well when you hold the best, third best, and small cards of your suit after one round has been played, on return of the suit by your partner, to play the third best, even with the certain knowledge that second best lies to your left. When next the suit is led, your King card is likely to draw the remaining cards, when your small ones win; whereas, if you take the trick with your best, the third round falls to your left-hand adversary, and you have no use for your small cards.

Cavendish gives another case. Ten tricks have been played, and each player remains with three cards of the same suit, as yet not opened (one card discarded somewhere). Suppose now second player puts on the Queen, and you, as third player, hold the Ace. It is practically certain that second player holds King also. If, then, you win with the Ace, you have to lead up to King guarded, and probably both tricks will be against you. But if you play a small card the second player wins, and has to lead from King guarded. He leads the small one; you pass it, and your partner may make, your Ace winning the last trick. In one case the chances are that you lose two tricks, and win but one; in the other they favour your winning two and losing one only. In any case the Ace makes.

Again, suppose you hold the long trump, and either a long suit or a suit which is nearly established, but not quite, the king-card of which is in your hands. If the adversaries lead this suit, you do well to let them take a trick or two in it till it is established; then, if they lead it again, you come in, and your small cards in the suit win. If they turn to another suit, your long trump brings you in, the winning card of the long suit is led, and the remaining cards falling, your small cards in the suit win.

We have now to consider the important points—leading trumps, and the play of trumps generally. It is here that science is chiefly shown in Whist, as we see from the saying of Cavendish, that his invention of the signal took away half the advantage he had derived from his scientific knowledge of the game. Yet we may doubt whether, after all, good players have not gained as much from the rash use which half-taught players make of the signal as they have lost from the invention of a system by which the attentive player learns at once when his partner urgently wants trumps led.

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